I claim:

1. An illumination optical system, comprising a light source which emits extreme ultraviolet light, a collimator, a fly's-eye mirror, and a condenser, positioned in order, and which Köhler-illuminates a prescribed illumination area on the emission side of the condenser, characterized in that

at least one among the plurality of unit mirrors comprised by the fly's-eye mirror is a correction mirror having reflectivity irregularities to correct a portion of or all of the illumination irregularities in the illumination area.

2. The illumination optical system according to Claim 1, characterized in that the ratio of the number of correction mirrors to the number of the plurality of unit mirrors is adjusted according to the extent of the illumination irregularities.

3. The illumination optical system according to Claim 1 or Claim 2, characterized in that multilayer films to improve reflectivity are provided on the plurality of unit mirrors, and a distribution to realize the reflectivity irregularities is imparted to the number of layers of the multilayer films on the correction mirrors.

4. The illumination optical system according to Claim 1 or Claim 2, characterized in that the plurality of unit mirrors are placed at orientations such that the oblique angle of incidence of incident light is a total reflection angle, and a distribution to realize the reflectivity irregularities is imparted to the surface structure of the reflecting surfaces of the correction mirrors.

5. The illumination optical system according to Claim 4, characterized in that the extreme ultraviolet light emitted by the light source is extreme ultraviolet light with a wavelength of 50 nm or shorter, and that the plurality of unit mirrors comprise

Ru or Mo material and are placed at orientations such that the oblique angle of incidence is 15° or less.

6. An illumination optical system, comprising a light source which emits extreme ultraviolet light, a collimator, a fly's-eye mirror, and a condenser, positioned in order, and which Köhler-illuminates a prescribed illumination area on the emission side of the condenser, characterized in that

a correction filter having transmissivity irregularities to correct a portion of or all of the illumination irregularities in the illumination area is placed on the incidence side of at least one among the plurality of unit mirrors comprised by the fly's-eye mirror.

7. The illumination optical system according to Claim 6, characterized in that the ratio of the number of correction filters to the number of the plurality of unit mirrors is adjusted according to the extent of the illumination irregularities.

8. The illumination optical system according to Claim 6 or Claim 7, characterized in that a distribution to realize the transmissivity irregularities is imparted to the thickness of the correction filter.

9. The illumination optical system according to any one of Claims 6 through 8, characterized in that the plurality of unit mirrors are each placed at an orientation such that the oblique angle of incidence of incident light is a total reflection angle.

10. The illumination optical system according to Claim 9, characterized in that the extreme ultraviolet light emitted by the light source is extreme ultraviolet light of wavelength 50 nm or shorter, and that the plurality of unit mirrors comprise Ru or

Mo material and are placed at orientations such that the oblique angle of incidence is 15° or less.

11. The illumination optical system according to any one of Claims 1 through 10, characterized in that the correction mirror corrects illumination irregularities occurring due to polarized light polarized in at least one direction among polarized light polarized in two intersecting directions which illuminates the illumination area.

12. The illumination optical system according to any one of Claims 1 through 5, characterized in that the correction mirror has a first reflectivity distribution characteristic for a first polarization component, to correct illumination irregularities due to the first polarization component illuminating the illumination area, and a second reflectivity distribution characteristic for a second polarization component polarized in a direction intersecting the direction of the first polarization component in the illumination area, to correct illumination irregularities due to the second polarization component.

13. The illumination optical system according to any one of Claims 6 through 10, characterized in that the correction filter has a first transmissivity distribution for a first polarization component, to correct illumination irregularities due to the first polarization component illuminating the illumination area, and a second transmissivity distribution for a second polarization component polarized in a direction intersecting the direction of the first polarization component in the illumination area, to correct illumination irregularities due to the second polarization component.

14. The illumination optical system according to Claim 13, characterized in that the correction filter comprises a first filter member, having a first transmissivity

distribution for a first polarization component to correct illumination irregularities due to the first polarization component illuminating the illumination area, and a second filter member, having a second transmissivity distribution for a second polarization component polarized in a direction intersecting the direction of the first polarization component in the illumination area, to correct illumination irregularities due to the second polarization component.

15. An illumination optical system, characterized in comprising:

a plurality of optical members to guide prescribed light to and illuminate a prescribed illumination area; and,

correction means for correcting illumination irregularities occurring due to a non-uniform optical intensity distribution of polarized light in the illumination area.

16. The illumination optical system according to Claim 15, characterized in that the correction means corrects illumination irregularities occurring due to polarized light polarized in at least one direction among polarized light polarized in two intersecting directions and illuminating the illumination area.

17. The illumination optical system according to Claim 15 or Claim 16, characterized in that the optical characteristics of the correction means are set so as to correct illumination irregularities of light of a first polarization component illuminating the illumination area, as well as to correct illumination irregularities of light of a second polarization component, polarized in a direction intersecting the direction of the first polarization component, and illuminating the illumination area.

18. The illumination optical system according to Claim 17, characterized in that the optical characteristics of the correction means are set so as to correct the

illumination irregularities, as well as to correct a difference in intensity between the first polarization component and the second polarization component.

19. The illumination optical system according to Claim 17, characterized in that the correction means comprises a first correction member having optical characteristics which correct the illumination irregularities of a first polarization component of light illuminating the illumination area, and a second correction member having optical characteristics which correct the illumination irregularities of a second polarization component of the light.

20. The illumination optical system according to any one of Claims 15 through 19, characterized in that the correction means is placed at a position optically conjugate with the illumination area, or at a position shifted by a prescribed amount from this position.

21. The illumination optical system according to any one of Claims 15 through 19, characterized in that at least one among the plurality of optical members is a fly's-eye mirror comprising a plurality of unit mirrors, and the correction means is provided on at least one of the plurality of unit mirrors.

22. An illumination optical system, comprising:

a plurality of reflecting members to guide extreme ultraviolet light of wavelength 50 nm or less and illuminate a prescribed illumination area; and,

correction means, placed at a position optically conjugate with the illumination area or at a position shifted by a prescribed amount from this position, and having optical characteristics which correct illumination irregularities in the illumination area;

and characterized in that

a multilayer film to improve reflectivity is formed on each of the reflecting surfaces of the plurality of reflecting members.

23. An illumination optical system, comprising:

a plurality of reflecting members to guide extreme ultraviolet light of wavelength 50 nm or less and illuminate a prescribed illumination area; and,

correction means, placed at a position optically conjugate with the illumination area or at a position shifted by a prescribed amount from this position, and having optical characteristics which correct illumination irregularities in the illumination area;

and characterized in that

at least one among the plurality of reflecting members is placed at an orientation such that the oblique angle of incidence of incident light is a total reflection angle.

24. The illumination optical system according to Claim 22 or Claim 23, characterized in that at least one among the plurality of reflecting members is a fly's-eye mirror comprising a plurality of unit mirrors.

25. An illumination optical system, comprising:

a plurality of reflecting members to guide prescribed light and illuminate a prescribed illumination area; and,

correction means having optical characteristics which correct illumination irregularities in the illumination area;

and characterized in that

the optical characteristics of the correction means are set taking into consideration information on the reflectivity distribution of at least one among the plurality of reflecting members.

26. The illumination optical system according to Claim 25, characterized in that the optical characteristics of the correction means are set taking into consideration actual measured information on the illumination irregularities, as well as the reflectivity distribution information.

27. The illumination optical system according to Claim 25 or Claim 26, characterized in that at least one among the plurality of reflecting members is a fly's-eye mirror comprising a plurality of unit mirrors, the optical characteristics of the correction means are set taking into consideration information on the reflectivity characteristic of at least one among the plurality of unit mirrors, and the correction means is provided on at least one among the plurality of unit mirrors.

28. The illumination optical system according to any of Claims 25 to 27, characterized in that a multilayer film to improve reflectivity is formed on the reflecting surfaces of the plurality of reflecting members.

29. The illumination optical system according to any of Claims 25 to 27, characterized in that at least one among the plurality of reflecting members is placed in an orientation such that the oblique angle of incidence of incident light is a total reflection angle.

30. The illumination optical system according to any of Claims 22 to 29, characterized in that the correction means corrects illumination irregularities occurring due to a non-uniform optical intensity distribution of polarized light in the illumination area.

31. The illumination optical system according to Claim 30, characterized in that the optical characteristics of the correction means are set to characteristics which

correct intensity irregularities of light of a first polarization component illuminating the illumination area, and which correct intensity irregularities of light of a second polarization component, polarized in a direction intersecting the direction of the first polarization component, and which illuminates the illumination area.

32. The illumination optical system according to Claim 31, characterized in that the optical characteristics of the correction means are set to characteristics which correct illumination irregularities, and which correct the intensity difference between the first polarization component and the second polarization component.

33. The illumination optical system according to Claim 31, characterized in that the correction means comprises first correction means, having optical characteristics which correct illumination irregularities of the first polarization component of light illuminating the illumination area, and second correction means, having optical characteristics which correct illumination irregularities of the second polarization component of the light.

34. A projection exposure apparatus, comprising:

a mask stage which holds a mask on a first surface;

a substrate stage which holds a photosensitive substrate on a second surface;

a projection optical system which projects an image of the first surface onto the second surface; and,

any one of the illumination optical systems of Claims 1 to 31, which simultaneously illuminates the first and the second surfaces by illuminating the first surface;

and characterized in that the illumination optical system is set in advance so as to correct illumination irregularities on the first surface or on the second surface, as the illumination area.

35. A microdevice manufacturing method, characterized in that the projection exposure apparatus according to Claim 34 is used to manufacture microdevices.

36. A projection exposure apparatus, having an illumination system which illuminates a mask and a projection system which projects the pattern of the mask onto a photosensitive substrate, characterized in that the illumination system comprises correction means for correcting illumination irregularities occurring due to non-uniformity of the optical intensity distribution of polarized light at the mask surface or at the photosensitive substrate surface.

37. The projection exposure apparatus according to Claim 36, characterized in that the correction means corrects irregularities occurring due to polarized light polarized in at least one direction among polarized light polarized in two intersecting directions.

38. The projection exposure apparatus according to Claim 37, characterized in that the correction means comprises a first correction member which corrects illumination irregularities due to light of a first polarization component among the light of a first and a second polarization component polarized in two intersecting directions, and a second correction member which corrects illumination irregularities due to light of the second polarization component among the light of the first and second polarization components polarized in two intersecting directions.

39. The projection exposure apparatus according to Claim 38, characterized in that the correction means comprises a third correction member which corrects a

difference in optical intensity between the first polarization component and the second polarization component.

40. A method of manufacture of an illumination apparatus, characterized in having:

a process of preparing an illumination optical system which guides light to an illuminated area; and,

a process of correcting irregularities due to a non-uniform optical intensity distribution of polarized light in the irradiated [sic] area.

41. The method of manufacture of an illumination apparatus according to Claim 40, characterized in that the correction process comprises a process of correcting irregularities occurring due to polarized light polarized in at least one direction among polarized light polarized in two intersecting directions.

42. The method of manufacture of an illumination apparatus according to Claim 40, characterized in that the correction process comprises a first correction process of correcting irregularities due to light of a first polarization component, among light of first and second polarization components polarized in two intersecting directions, and a second correction process of correcting irregularities due to light of the second polarization component, among light of the first and second polarization components polarized in two intersecting directions.

43. The method of manufacture of an illumination apparatus according to Claim 42, characterized in that the correction process comprises a third correction process of correcting a difference in optical intensity between light of the first polarization component and light of the second polarization component.

44. The method of manufacture of an illumination apparatus according to any among Claims 40 to 43, characterized in that the illumination optical system guides light of wavelength 50 nm or less to the illuminated area.

45. A method of adjustment of a projection exposure apparatus, characterized in having:

a process of preparing a projection exposure apparatus, comprising an illumination system which illuminates a mask and a projection system which projects an image of the pattern of the mask onto a photosensitive substrate; and,

a process of correcting irregularities due to the non-uniform optical intensity distribution at the mask surface or at the photosensitive substrate surface.

46. The method of adjustment of a projection exposure apparatus according to Claim 45, characterized in that the correction process comprises a process of correcting irregularities occurring due to polarized light polarized in at least one direction among polarized light polarized in two intersecting directions.

47. The method of adjustment of a projection exposure apparatus according to Claim 45, characterized in that the correction process comprises a first correction process of correcting irregularities due to light of a first polarization component, among light of first and second polarization components polarized in two intersecting directions, and a second correction process of correcting irregularities due to light of the second polarization component, among light of the first and second polarization components polarized in two intersecting directions.

48. The method of adjustment of a projection exposure apparatus according to Claim 47, characterized in that the correction process comprises a third correction

process of correcting a difference in optical intensity between light of the first polarization component and light of the second polarization component.

49. The method of adjustment of a projection exposure apparatus according to any of Claims 45 to 48, characterized in that the illumination system illuminates the mask with light of wavelength 50 nm or less.

50. A microdevice manufacturing method, which uses a projection exposure apparatus adjusted using the method of adjustment of a projection exposure apparatus according to any of Claims 45 to 49, characterized in comprising:

a process of illuminating the mask using the illumination system; and,

a process of using the projection system to project the pattern image of the mask onto the photosensitive substrate.

51. A method of manufacture of a projection exposure apparatus, characterized in that a projection exposure apparatus is manufactured using the method of adjustment of a projection exposure apparatus according to any of Claims 45 to 49.